Chapter 5. South Coast Hydrologic Region

Within the South Coast Hydrologic Regional water wholesalers and retailers, groundwater agencies, and watershed planners and managers are becoming increasingly successful in working together to implement a large and diverse array of local water supply and water quality projects. In turn, this increased level of cooperation and integrated planning is making the region more flexible and less dependent on imported water, particularly during dry years.

This profile, after describing the characteristics of the region, provides examples of the region's challenges, accomplishments, and plans to meet the water needs of the future. There are many more examples than are given here, but it is important to note that today there are many more major players with important roles to play in providing reliable, affordable, high quality water, and the lines between these entities are increasingly blurred.

Setting

The South Coast Hydrologic Region, in the southwest portion of the state, is California's most urbanized and populous region. It contains slightly more than half of the state's population (54 percent) but covers only seven percent of the state's total land area. The topography includes a series of nearly flat coastal plains and valleys, many broad but gentle interior valleys, and several mountain ranges of low and moderate elevation.

The region extends about 250 miles along the Pacific Coast from the Ventura-Santa Barbara County line in the north to the international border with Mexico in the south (Figure 5-1). The region includes all of Orange County and portions of Ventura, Los Angeles, San Bernardino, Riverside, and San Diego counties.

There are several prominent rivers in the region, the Sespe, Ventura, Santa Clara, Los Angeles, San Gabriel, Santa Ana, San Jacinto, Santa Margarita, San Luis Rey, San Dieguito, Sweetwater, and Otay rivers. Some segments of these rivers have been extensively lined and in other ways modified for flood control. Natural runoff of the region's streams and rivers averages about 1.2 million acre-feet annually.

Climate

The region has a mild, dry subtropical climate where summers are virtually rainless, except in the mountains where late summer thunderstorms sometimes occur. About 75 percent of the region's precipitation falls from December through March. The coastal plains and the interior valleys receive, on average, 12 to 18 inches of annual precipitation, depending on the station, but the climate allows for a much wider variation from year to year. Much of the 20 to 40 inches of annual average precipitation in the higher mountains falls as snow.

Population

The region's 2000 population was 18,223,000. The fastest growing portion of the South Coast region is that known as the Inland Empire, which includes the inland valleys of Riverside and San Bernardino counties. The region contains seven of the state's fastest-growing cities, in terms of percentage change (Temecula, Chula Vista, Irvine, Riverside, Fontana, Rancho Cucamonga, and Murietta). The city of Los Angeles is the state's biggest city. Its population grew from 3,486,000 in 1990 to 3,645,000 in 2000. The population in San Diego County is concentrated along the coastal terraces and valleys, and south of Camp Pendleton, the U.S. Marine base. In 2000, the city of San Diego was America's 7th largest city, and California's second, with 1,223,000 persons. Figure 5-2 provides a graphical depiction of the South Coast region's total population from 1960 through 2000, with current projections to year 2030.

In 1994, State Water Resources Control Board adopted Water Right Decision 1631 amending the City of Los Angeles' water rights for diverting water from the Mono Basin. The decision restricts diversions from the basin to increase and maintain Mono Lake's level to 6,391 feet above sea level. During the period of Mono Lake's transition to the 6,391-foot level (estimated to take about 20 years), the maximum amount of water that Los Angeles can divert from the basin is 16 taf/yr. Long-term Los Angeles diversions from the Mono Basin are projected to be about 31 taf/yr after Mono Lake has reached the 6,391-foot level, or one-third of the city's historical diversions from the Mono Basin.

Land Use

The mild climate and ample expanse of gentle landscapes in the South Coast region have encouraged a variety of land uses since the first great development boom of the late 1880s. Residential and commercial development, and freeways have continued to extend their way onto lands that had long been pastoral, if not agricultural. Irrigated agriculture now occupies only a seventh as much land as urban uses. Environmental water use is primarily limited to relatively small, managed wetland areas, wildlife areas, lakes, and riparian areas.

Although the acreage devoted to its agriculture has continued to decline in recent years, the region still produced crops on about 280,000 acres in 2000, mostly high-value citrus and vegetable crops and assorted nursery products. For example, annual agricultural products in San Diego County are valued at more than $1.3 billion. The top crop production value is flowers and foliage, and an extensive citrus and avocado-growing area stretches along Interstate 5 for about 30 miles into the county. Nearly all the 36,000 acres of avocados in this hilly area are grown on slopes and irrigated with high-pressure mini-jet sprinklers and precision emitters.

Water Supply and Use

The region has developed a diverse mix of both local and imported water supply sources. An array of local projects such as water recycling, groundwater storage and conjunctive use, conservation, brackish water desalination, water transfer and storage, and infrastructure enhancements have been developed to complement imported water supplies. The region imports water through the State Water Project (SWP), the Colorado River Aqueduct (CRA), and the Los Angeles Aqueduct (LAA). This diverse mix of sources provides flexibility in managing supplies and resources in wet and dry years. Figure 5-3 provides a graphical presentation of all of the water supply sources that are used to meet the developed water uses within this hydrologic region for 1998, 2000 and 2001. Figure 5-4 presents a bar chart that summarizes all of the dedicated and developed urban, agricultural and environmental water uses within this hydrologic region for 1998, 2000 and 2001.

The Metropolitan Water District of Southern California (MWD) imports an average of 1.22 million acre-feet of water from the SWP and 550,000 acre-feet or more of water from the CRA (depending on the availability of surplus water). MWD wholesales the water to a consortium of 26 cities and water districts that serve 18 million people living in six counties stretching from Ventura to San Diego.

Fifteen percent of the region's water supply is provided by agencies other than MWD. These agencies import water from the SWP or provide local supplies, usually groundwater. Agencies that import SWP water include Castaic Lake Water Agency, San Bernardino Valley Municipal Water District (SBVMWD), Ventura County Flood Control District, San Gorgonio Pass Water Agency, and the San Gabriel Valley Municipal Water District.

Groundwater and groundwater agencies are important to the water supply picture of the region, meeting about 23 percent of water demand in normal years and about 29 percent in drought years. There are 56 groundwater basins in the region. In some California groundwater basins, as the demand for groundwater exceeded supply, landowners and other parties turned to the courts to determine how much groundwater can rightfully be extracted by each user. In a process known as court adjudication, the courts study available data to arrive at a distribution of groundwater that is available each year, usually based on the California law of overlying use and appropriation. There are 19 court adjudications for groundwater basins in California, mostly in Southern California. In 15 of these adjudications, the court judgment limits the amount of groundwater that can be extracted by all parties based on a court-determined safe yield of the basin. The basin boundaries are also defined by the court.

It is interesting to note that during the latter stages of the 1987-1992 drought and for several years afterward, water supply deliveries and M&I uses for many retail water districts in the Region were slightly less than in the late 1980s. The City of Los Angeles, exemplifies this trend. For WY 1990, the City used 677.1 taf of water from various supplies. In 1998 and 2000, the totals were 596.7 and 679.5 taf respectively. The increase in water supplies in 2000 was less than one percent over the 1990 quantities despite a net increase in the population served of more than 400,000.

Most basin adjudications have resulted in either a reduction or no increase in the amount of groundwater extracted. As a result, agencies often import surface water to meet increased demand. The original court decisions provided watermasters with the authority to regulate extraction of the quantity of groundwater; however, they omitted authority to regulate extraction to protect water quality or to prevent the spread of contaminants in the groundwater. Because water quantity and water quality are separable, watermasters are recognizing that they must also manage groundwater quality.

Water use efficiency measures, which bring wastewater agencies into partnerships with surface and groundwater managers, will play an increasingly significant role in meeting the region's water needs. The best currant data is the 2002 Statewide Recycled Water Survey by the State Water Resources Control Board (SWRCB), which estimated that recycled municipal water delivery was about 275,000 acre-feet per year in Southern California. According to the MWD's 2003 Annual Progress Report, about 204,000 acre-feet of recycled water was developed within its service area in fiscal year 2003. By the year 2010, MWD expects that its service area will produce about 410,000 acre-feet of water through water recycling, groundwater recovery, or seawater desalination.

West Basin Municipal Water District (WBMWD), the largest water recycler in the region, has developed more than 31,000 acre-feet of recycled water. Currently, about 13,700 acre-feet of recycled water is beneficially reused within the San Diego County Water Authority (SDCWA) service area annually, 94 percent for agriculture, landscape irrigation, and other manufacturing and industrial uses. The remaining 6 percent is recharged into groundwater basins.

Water use efficiency measures, which are partnering wastewater treatment agencies with wholesale and retail water districts, will continue to have important impacts on the region's supplies and demands. A combination of active and passive measures has contributed to decreases in urban demands in the region. Examples of active water use efficiency programs would be the installation of ultra-low-flush toilets and other water efficient appliances for residential, industrial, and institutional uses and the promotion of water efficient landscaping and irrigation. Even greater water supply savings are being achieved from passive water use efficiency measures. Passive water measures involve changes in the water code that require manufacturers to offer customers water-saving devices. MWD reports that its members have urban programs that conserve about 65,000 acre-feet annually through active programs, but passive conservation makes the actual savings much larger.

About 14 percent of the overall water use in the region is due to agricultural activities. The sources of water supplies for irrigation operations in the region differ throughout the region. Groundwater is the primary source of water for the agricultural activities on the coastal plain of Ventura County. In the middle section, combinations of groundwater and imported water are used. In the southern portion, primarily San Diego County, imported water supplies are used almost exclusively.

MWD initiated several agricultural water conservation and transfer programs, including a program with the Imperial Irrigation District (IID) that conserved 105,130 acre-feet in 2003 and a crop rotation and water supply program with Palo Verde Irrigation District that saved about 186,000 acre-feet of water from 1992 through 1994, which is a full-scale program that is under way. In addition, SDCWA is in the initial stage of an agreement with IID that will deliver up to 200,000 acre-feet of conserved water annually to San Diego County.

The regional water balance table (Table 5-1) summarizes the detailed regional water accounting contained in the water portfolio section at the end of this regional description. As shown in the table, losses are about the same as precipitation and outflows to the ocean are relatively small. Imports are a large part of the applied water in the region.

Acronyms Used in the South Coast Regional Report

CBDA – California Bay-Delta Authority

CRA – Colorado River Aqueduct

CVWD – Coachella Valley Water District

DBPs – disinfection by-products

DWR – California Department of Water Resources

IID – Imperial Irrigation District

LAA – Los Angeles Aqueduct

LACDPW – Los Angeles County Department of Public Works

LADWP – Los Angeles Department of Water and Power

mgd – million gallons per day

MWA – Mohave Water Agency

MWD - Metropolitan Water District of Southern California

OCWD – Orange County Water District

QSA – Quantification Settlement Agreement

RWQCB – Regional Water Quality Control Board

SAWPA – Santa Ana Water Project Authority

SBVMWD – San Bernardino Valley Municipal Water District

SCCWRRS – Southern California Comprehensive Water Reclamation and Reuse Study

SWRCB – State Water Resources Control Board

SDCWA -- San Diego County Water Authority

SWP – State Water Project

TDS – total dissolved solids

USBR – United States Bureau of Reclamation

VOCs – volatile organic compounds

WBMWD – West Basin Municipal Water District

State of the Region

Over the past decade, the region has improved water supply reliability in the face of reduced supplies from the Owens Valley and Mono Basin and uncertainty regarding the amount of imports from the State Water Project and Colorado River. Water agencies have been proactive in continuous planning to manage changing water supply and demand conditions in the region. While dependent on imported water for at least 50 percent of its water supplies, the region's water agencies have compiled a wide array of water management tools and water management and planning practices that bring local water resources on a more equal footing with imported water.

Challenges

Like many regions in the state, water quality and water supply challenges are intertwined. The South Coast region must manage for uncertainties caused by population and economic growth. Growth will not only affect demand, but it will add contamination challenges from increases in wastewater discharges and urban runoff, as well as increased demand for water-based recreation. Outside the region, environmental and water quality needs in the Delta, Colorado River, and Owens River/Mono Basin systems affect imported water supply reliability and quality. The region must also assess and plan for impacts of climate variations and global climate change, as well as the cost of replacing aging infrastructure.

Given the size of the region and the diverse sources of water supply, the challenges to the region's water quality are varied. Surface water quality issues in the South Coast are dominated by storm water and urban runoff, which contribute contaminants—including trash—to local creeks and rivers. These pollutant sources, as well as sanitary sewer overflows, ocean outfalls, tidal input, and even wildlife, can degrade coastal water quality, closing beaches and increasing the health risks from swimming. These sources also specifically affect water quality in the major bays—Santa Monica, Newport, and San Diego. Newport Bay, for instance, suffers from algae blooms (due to excess nutrients), toxicity to aquatic life, high bacterial counts, and sedimentation. Shipping can also influence water quality, especially at the U.S. Navy base in San Diego Bay and the Long Beach and Los Angeles Harbors, where there are toxic sediment hot spots. Harbors, marinas and recreational boating threaten water quality via ballast water discharges, which can introduce invasive species, petroleum and sewage discharges and spills, biocides from boat hulls, boat cleaning and fish wastes, trash, and reduced water circulation. The South Coast Wetlands Recovery Project works to restore wetland habitat and eradicate exotic species in many watersheds of the region. Several dedicated wildlife and ecological reserves are located along the South Coast as well.

Constructed wetland projects in Hemet/San Jacinto, San Diego Creek, and Prado Basin, remove large loads of nitrogen from wastewater and urban runoff. Salinity, nitrogen, and microbes are the major contaminants in the Santa Ana River, affecting downstream beneficial uses such as swimming and groundwater recharge for domestic use. Because of upstream irrigation diversions, flows in the middle and lower Santa Ana are composed mostly of reclaimed wastewater, creating a year-round flow that is high in salinity. The Santa Ana suffers as well from an invasive exotic species, the giant reed *Arundo donax*. Other non-native, invasive species of concern in this region include the marine alga *Caulerpa taxifolia* along the San Diego coast, and salt cedar (*Tamarix sp.*) in various streams and rivers; both, like *Arundo donax*, have the potential to wreak havoc with native ecosystems. Lake Elsinore, the largest natural freshwater lake in southern California, experiences nuisance algae blooms from excess nutrients, impairing its ecological and recreational beneficial uses. Local groups have implemented many wetland and river restoration projects to improve water quality, for example, at Bolsa Chica and in Ballona Creek, as well as along the Los Angeles and San Gabriel Rivers. The U.S. and Mexico jointly built the International Wastewater Treatment Plant to treat a portion of the sewage from Tijuana, which flows across the international boundary into the San Diego basin.

The Chino Basin hosts the highest concentration of dairy animals in the U.S. In a 40-square-mile area, well over 300,000 animals are maintained on about 300 dairies. Because of a lack of sufficient land to dispose of manure, as well as flooding from expanding suburban development, dairy runoff contributes nitrate, salts, and microorganisms to groundwater as well as surface water. Since 1972, the Santa Ana Regional Water Quality Control Board (RWQCB) has issued waste discharge requirements to the dairies in this basin; in addition, pilot projects for sewering dairies and treating dairy washwater have also been recently completed. ,Water utilities can use desalters to recover groundwater from brackish aquifers such as the Chino Basin, but only if they have access to the regional brine line (the Santa Ana River Interceptor). Groundwater quality in this basin is integrally related to the surface water quality downstream in the Santa Ana River, which in turn serves as a source for groundwater recharge in Orange County. Orange County Water District and, to the north, West Basin Municipal Water District, operate groundwater injection programs to form hydraulic barriers, to protect aquifers from seawater intrusion.

Public health, environmental and economic concerns about the total dissolved solids (TDS) content of wastewater, and the presence in treated wastewater of pharmaceuticals, household products, and other emerging contaminants, have grown with the expansion of water recycling programs in the South Coast region. The high salinity of imported Colorado River water limits the number of times water can be reused before the salt content becomes too high and wastewater can only be discharged to the ocean. Increased use of recycled water and marginal quality groundwater supplies during droughts can result in water quality problems for some local supplies that endanger future water management projects. For instance, groundwater recharge potential may be restricted because the RWQCB has established TDS requirements for recharge water in some groundwater basins to protect existing basin water quality.

The average TDS concentration of MWD's Colorado River Aqueduct (CRA) water is about 900 mg/L while the average TDS content of SWP supplies is about 300 mg/L. The Los Angeles Aqueduct (LAA) supply has a significantly lower TDS concentration, typically about 160 mg/L. TDS levels in local groundwater supplies in the region vary considerably, ranging from 200 mg/L (Cucamonga Basin near Upland) to more than 1,000 mg/L (Arlington Basin near Corona). Local water uses also contribute significantly to overall salinity levels. For example, municipal and industrial use of water adds between 250 and 500 mg/L of TDS to wastewater. Key sources of local salts include water softeners (typically contributing from 5 to 10 percent of the salt load) and industrial processes.

The long-term salt balance of the region's groundwater basins is an increasingly critical management issue. Smaller basins like the Arlington and Mission groundwater basins were abandoned as municipal supplies because of high salinity levels. These basins have only recently been restored through brackish water desalting projects. Blending SWP and CRA supplies, or using the SWP's relatively low TDS supplies for groundwater replenishment, is a strategy in some areas. However, some inland water districts that reuse wastewater have salt accumulation problems in their groundwater basins because they lack an ocean outfall or stream discharge. Some districts have established access to a brine line for exporting salt and concentrated wastes to a coastal treatment plant and ocean outfall, while others have not found construction of a brine line to be economical.

Beyond salinity, several established and emerging contaminants of concern to the region's drinking water supplies include disinfection by-products (DBPs), perchlorate, arsenic, nitrosodimethylamine (NDMA), hexavalent chromium and methyl tertiary butyl ether (MTBE). Historically, industrial solvents have extensively impacted the groundwater underlying the San Gabriel Valley. Imported water from the Owens Valley is of excellent water quality, and imported Delta water quality is generally good. Nonetheless, arsenic is a concern in the Owens Valley supply, and Delta water can contain precursors—such as organic carbon and bromide—of potentially carcinogenic disinfection by-products, if treated with certain disinfection processes necessary to inactivate pathogens in drinking water.

Perchlorate, a component of rocket fuel that can disrupt thyroid gland function, has particularly impacted the groundwater in Pasadena and the Rialto-Colton-Fontana region. Perchlorate is also a concern in Colorado River water, largely due to contamination from inactive ammonium perchlorate manufacturing facilities in Nevada. Perchlorate contamination of wells in the San Gabriel Valley, which resulted in the deactivation of many of these wells, has led to testing of ion exchange technologies for the removal of this constituent.

Naturally occurring arsenic, a known human carcinogen, is another contaminant of concern, present in the LAA supply as well as local aquifers. The city of Los Angeles currently manages arsenic concentrations in LAA water through treatment and exchanges with MWD. In Southern California, local water sources with high arsenic levels are found in Los Angeles, San Bernardino, and Riverside counties.

NDMA, a probable human carcinogen, is associated with the production of rocket fuel, and the manufacture of explosives, paints, and other industrial goods. Contamination of surface and groundwater by NDMA at missile and rocket fuel manufacturing and storage sites is a significant concern, particularly for groundwater supplies. NDMA can also be formed during the treatment of wastewater, which is a threat to aquifers that are recharged with reclaimed wastewater and later used for drinking water.

Groundwater contamination by hexavalent chromium, a suspect carcinogen better known as chromium 6, in the Los Angeles basin and elsewhere, has resulted from its use in various industries including aerospace and plating. In Los Angeles County, Los Angeles RWQCB staff is overseeing assessment and cleanup of sites impacted by hexavalent chromium at defense-related businesses and manufacturing and other industrial sites.

MTBE and other oxygenates have been added to gasoline in areas with severe air pollution to help gasoline burn more cleanly and comply with federal law. Unfortunately, MTBE can also contaminate groundwater when pipelines, fuel tanks, and other containers or equipment leak, when fuel is spilled, and when unburned fuel is discharged from watercraft. The high mobility and low biodegradability of MTBE present a significant risk to aquifer supplies. MTBE has been widely detected in South Coast groundwater, surface water, and imported water supplies. In particular, MTBE has limited the use of most of Santa Monica's wells, making the city more dependent upon imported water and treatment systems. California has recently phased out MTBE from its gasoline supplies. As of January 1st, California refineries no longer blend MTBE into gasoline. Ethanol is now used as the primary oxygenate in areas requiring oxygenate additives under federal law.

The 198-foot-high Matilija Dam in Ventura County has lost most of its water supply and flood control benefits due to sediment deposits. Originally built in 1947 to store up to 7,018 acre-feet of water, siltation has reduced its effective storage capacity to about 500 acre-feet. Moreover, the Matilija Dam has had adverse effects on the ecosystem of the Ventura River Watershed, which supports several threatened and endangered species. The structure blocks riparian and wildlife corridors between the Ventura River and Matilija Creek. By trapping sediment that would otherwise be carried downstream, the dam also contributes to the long-term erosion of estuaries and beaches along the Ventura River.

The Matilija Dam Ecosystem Restoration Feasibility Study, a joint study by the Ventura County Watershed Protection District and the U.S. Army Corps of Engineers, is one of the largest dam removal studies ever undertaken in the U.S. The study recommended the dam's removal in its July 2004 Public Draft Report and EIS/EIR. However, there are disputes over rights to the remaining water supply. The Casitas Municipal Water District, which leases the dam, pipeline and rights to the dam's water from the Ventura County Watershed Protection District, is concerned with how this lost water supply to Casitas will be recovered once the Matilija Dam and reservoir are removed. Studies and discussions are continuing, in order to develop solutions for the water supply impacts that could result from removal of this dam.

California's use of Colorado River water is being managed to ensure that the region reduces by 2016 the use of this water from a high of 5.3 million acre-feet in previous years to its 4.4 million acre feet annual apportionment. Until 2016, California can receive surplus water from the river depending on the storage level in Lake Mead. The Colorado River Board of California developed the basic plan, called California's Colorado River Water Use Plan or the "4.4 Plan," that outlines steps to be taken to reduce the state's use of Colorado River water. Those steps include a water transfer of conserved water from IID to SDCWA, the lining of earthen canals, water storage and conjunctive use programs, water exchanges, improved reservoir management, salinity control, watershed protection, water reuse, and other measures. The signing of the Quantification Settlement Agreement (QSA) in 2003 enabled implementation of the 4.4 Plan.

Drought is a constant concern for water districts in the region. This has led to an emphasis on the development of local supplies. Today, about 50 percent of Southern California's demand is being met through such local supplies as water conservation, recycling, and groundwater recovery. The uncertainty caused by scientific findings on climate change also has caused water agencies to question the reliability of imported sources.

Groundwater overdraft is a challenge to the region. Historically, agricultural, industrial, and urban development has led to extraction of increasing amounts of groundwater from many of the region's basins. Over-extraction of groundwater has caused seawater intrusion, contributed to land subsidence, and led to disputes over pumping rights in many of the region's basins.

Accomplishments

The region has developed a diverse water portfolio that is balanced between local and imported supplies. The primary objectives of the region's water agencies are to provide high quality, reliable, and affordable water. To achieve this balance, the region has constructed additional surface storage capacity and employed several local resource management strategies including improved conveyance facilities, agricultural and urban water use efficiency, water recycling, groundwater conjunctive use, groundwater remediation, brackish water desalination, drinking water treatment, watershed management, and groundwater banking and water transfers from outside the region. These diversified strategies guide the management of available resources in a manner that allows greater flexibility when adapting to water quality or supply challenges.

Diamond Valley Lake was built in the late 1990s to better manage water supplies between wet and dry years. Located near Hemet in southwestern Riverside County, the 800,000 acre-foot reservoir nearly doubles the region's existing surface storage capacity and provides increased terminal storage for SWP and Colorado River water. Diamond Valley Lake would provide the MWD service area with a six-month emergency imported supply after an earthquake or other disaster. It would also provide water for drought protection and peak summer demands.

The SDCWA finished construction of Olivenhain Reservoir in 2003 and began filling its 24,000 acre-foot capacity with imported water. The reservoir, just southwest of Escondido in northern San Diego County, will provide water to the San Diego region during an emergency that cuts off normal imported water deliveries. It is the first milestone completed in the SDCWA Emergency Storage Project, which will add 90,100 acre-feet of storage capacity within the county.

The Inland Feeder is a conveyance facility for delivery of SWP water made available by the enlargement of the East Branch of the California Aqueduct (Figure 5-5). When it is completed, the Inland Feeder will deliver water by gravity to Diamond Valley Lake via 43.7 miles of tunnels and pipeline that start at Devil Canyon and tie into the CRA and Eastside Pipeline. The Inland Feeder will provide system reliability by linking the SWP and Colorado River systems and will improve water quality by allowing greater blending of SWP and Colorado River waters.

An agreement between MWD and SBVMWD allows MWD to purchase additional SWP water for blending with Colorado River water and to store water from San Bernardino's groundwater basin, which helps resolve long-standing groundwater issues. The San Gorgonio Pass Water Agency recently extended the pipeline east from Mentone bringing SWP water to Beaumont.

On Oct. 10, 2003, representatives from MWD, SDCWA, IID, and Coachella Valley Water District (CVWD) signed the Quantification Settlement Agreement (QSA) and several other agreements that will execute several key components of the Colorado River Water Use Plan including establishing water budgets from IID and CVWD and making water transfers viable. The QSA includes a water transfer from IID to SDCWA, which began in 2003 and eventually will provide up to 200,000 acre-feet per year to San Diego County. The transfer will help increase water supply reliability for the South Coast Region.

In 2003, the SDCWA and IID consummated the largest water transfer in the history of the United States. This transfer, which will eventually move 200,000 acre-feet of conserved water by farmers in the Imperial Valley annually to San Diego County, has helped reduce SDCWA's dependence on MWD and diversified its sources of imported water. The initial term of the agreement is for 45 years; a 30-year extension is possible with the mutual consent of both parties. In addition, SDCWA will gain an additional 77,000 acre-feet of water per year through projects it will undertake to line the All-American and Coachella canals to stop water loses that occur because of seepage. This program has a 110-year term.

State agencies, including DWR, SWRCB, and the California Bay-Delta Authority (CBDA), and the U.S. Bureau of Reclamation (USBR) are making major statewide investments in urban and agricultural water conservation programs, which regional and local agencies leverage with their own investments to reduce demand. As discussed above, additional demand reduction comes from passive conservation achieved through changes in manufacturing codes.

An example of this regional leveraging is MWD’s conservation program with its member agencies. Since 1992 Metropolitan has invested more than $191 million in conservation programs and related activities. In 2003, MWD implemented a new rate structure that includes a funding source dedicated to conservation, recycling, groundwater recovery, and other local projects. The backbone of MWD’s conservation program is the Conservation Credits Program, initiated in 1988, that contributes $154 per acre-foot of water conserved to assist member agencies in pursuing conservation opportunities. In tandem to these urban conservation efforts, MWD has an agricultural water savings program that began in 1990 with IID. To date, MWD has invested more than $193 million to construct, operate, and maintain projects with IID that will conserve more than 100,000 acre-feet of agricultural water every year to transfer to MWD. In 2003, water savings were 105,130 acre-feet. This agreement is for a minimum of 43 years.

A 35-year agreement for a land management, crop rotation and water supply program is in place with the Palo Verde Irrigation District and MWD. Palo Verde farmers will stop irrigating between 7 to 29 percent of their land, on a rotating basis, securing about 8 billion to 36 billion gallons of water each year for use in Southern California. MWD will provide an estimated $6 million to local community improvement programs to counter potential negative economic impacts to the Palo Verde community.

More than $440 million, primarily from State Propositions 13 and 50 and federal Title XVI grants, have been invested in water recycling programs in the region, resulting in over 500,000 acre-feet of water available per year, including Orange County Water District’s (OCWD) current reuse of Santa Ana River water. The growth in recycled water will be about 400,000 acre-feet over the next decade.

Under construction, the OCWD and Orange County Sanitation District’s new Groundwater Replenishment System is designed to increase current water reuse by taking treated sewer water that is currently being released into the ocean and purifying it through microfiltration, reverse osmosis, and ultraviolet light with hydrogen peroxide advanced oxidation treatment. The purified water will be injected into a seawater barrier and pumped to percolation ponds to seep into deep aquifers and blend with Orange County’s other sources of groundwater. The Groundwater Replenishment System is projected to begin delivery of purified water in 2007, with potential for future expansion as needed.

The development of groundwater storage and conjunctive use programs has improved the region’s water supply reliability and overall water quality. A 2000 study by the Association of Groundwater Agencies indicates that existing conjunctive use programs in the region provide an estimated 2.5 million acre-feet of water per year, which is a fraction of the region’s conjunctive use potential. It is estimated that more than 21.5 million acre-feet of additional water could be stored and used in Southern California groundwater basins with the resolution of institutional, water quality, and other issues. State agencies have supported the development of 34 groundwater management and storage projects in the region.

As a result of MWD's replenishment services pricing program, local agencies are implementing conjunctive use programs. They are storing imported water in groundwater basins and increasing their groundwater use during the summer and during drought years. It is estimated that an average of 100,000 acre-feet per year of groundwater supply is now produced as a result of MWD's discount pricing deliveries. MWD has identified the potential for 200,000 acre-feet of additional groundwater production during drought years. To accomplish this additional drought year production, about 600,000 acre-feet of dedicated storage capacity within the local basins may be required.

An example of such a conjunctive use program is the Las Posas Basin Aquifer Storage and Recovery Project. The Calleguas Municipal Water District, in cooperation with MWD, has initiated a conjunctive use program in the Las Posas Groundwater Basin of Ventura County. The project is designed to store a maximum of 210,000 acre-feet of SWP water supplies that can be used during water supply shortages. The project will be phased into operation with full operation anticipated by 2010. To date, 18 wells have been constructed and about 50,000 acre-feet of water is in storage.

Recent groundwater storage agreements allow additional storage in wet years. Groundwater agreements to be implemented in the region will put more than 53 billion gallons of water into storage in Orange County, the west San Gabriel Valley and the Inland Empire. MWD has reached agreements with the Kern-Delta Water District, the Mojave Water Agency, and the North Kern Water Storage District, outside the region, where it also participates in the Semitropic Water Banking and Exchange Program in Kern County, the Arvin-Edison Water Storage Program in Kern County, and the Kern-Delta Storage Program (Figure 5-6). Castaic Lake Water Agency entered into a short-term groundwater banking arrangement with Kern County.

Groundwater quality issues are being addressed in the region. In the San Gabriel Valley, the Main San Gabriel Basin Watermaster, San Gabriel Basin Water Quality Authority, Upper San Gabriel Valley Municipal Water District, and a number of water suppliers have actively pursued technical remedies for the groundwater quality problems described earlier. Several treatment facilities for the volatile organic compounds (VOCs) were first constructed in the 1990s. As of June 2002, 18 treatment facilities are operational. Groundwater supplies with high nitrate levels are either blended with other supplies or not used at all. Similar cleanup efforts are being pursued in the San Fernando Basin by the Los Angeles Department of Water and Power (LADWP) and the Upper Los Angeles River Basin Watermaster. Several groundwater desalting plants are currently operated by the Santa Ana Water Project Authority (SAWPA), Chino Basin Desalting Authority, city of Corona, Eastern Municipal Water District's, Irvine Ranch Water District, the city of Oceanside, West Basin MWD, and the Sweetwater Authority. Brackish groundwater desalting delivers about 100,000 acre-feet of water today and will increase to about 250,000 acre-feet during the next decade. Proposition 13 water bond funding is being utilized to expand desalting capacity in the region.

The SAWPA is a joint powers authority in the eastern portion of the region. It represents five agencies in the counties of Orange, Riverside, and San Bernardino and covers a watershed area of 2,650 square miles. It provides effective and concerted watershed planning on a regional basis.

SAWPA operates a brine disposal line, which facilitates disposal of waste brine from regional desalting plants and operates the Arlington Desalter. SAWPA has been particularly successful in recent years in assisting its member agencies in implementing several new water resources projects that enhance groundwater recovery, groundwater storage, water quality improvement and water recycling through the use of Proposition 13 Water Bond funding. About 20 potential groundwater recovery projects were evaluated with a net yield of 95,000 acre-feet per year.

The Port Hueneme Water Agency was formed to develop and operate a brackish water desalting demonstration facility for its member agencies in western Ventura County. Its goals are to improve the quality and reliability of local groundwater supplies and decrease seawater intrusion in the Oxnard Plain. The facility will provide a full-scale demonstration of side-by-side operation of three brackish water desalting technologies: reverse osmosis, nanofiltration, and electrodialysis reversal.

Increasingly, the region's water wholesalers, such as Castaic Lake Water Agency, San Bernardino Valley Municipal Water District, Mojave Water Agency (MWA), MWD, and SDCWA are acquiring part of their future supplies from water marketing or exchange arrangements, using the CRA and California Aqueduct to convey the water.

An agreement in late 2003 between MWA and MWD calls for the exchange of 75,000 acre-feet of SWP flow from the California Aqueduct. Under the accord, MWA received about 23,000 acre-feet of MWD's state-authorized flow via the aqueduct at the end of 2003. Additional flow through this agreement will depend on the amount of rain or snowfall available to the SWP. Water will be stored in the high desert's underground aquifers to help replenish the water table, prevent well-deepening by residents, and meet future needs.

The South Coast region has placed an increased emphasis on improving watershed management and protection. Local, State, and federal agencies and nonprofit organizations have invested in several management efforts, including watershed education, monitoring, and wetlands management and protection. There are over 40 entities that are generating new partnerships and coalitions among various stakeholders in attempts to integrate elements of flood hazard mitigation, groundwater and storm water conservation, management of the quality of storm water runoff, along with other natural resources, to better manage sources. Following are examples of the region's watershed programs:

- SAWPA, the largest watershed organization, is established to protect and enhance the quality and supply of the watershed and protect the environment by implementation of its watershed plan.
- Under the guidance of the Los Angeles County Department of Public Works, watershed management plans are being developed for five coastal watersheds within Los Angeles County. Eleven watershed and sub-watershed plans have been completed with eight pending or proposed plans under way, making Los Angeles County the most productive county in the state in terms of watershed planning.
- The Hemet/San Jacinto Multipurpose Constructed Wetlands is a collaborative project between the USBR, and Eastern Municipal Water District. The wetlands is nearly 60 acres with five interconnected marshes. It provides nitrogen removal of secondarily treated recycled water and habitat for migratory waterfowl, shore birds, and raptors along the Pacific Flyway.
- The San Diego Creek Watershed is operated by the Irvine Ranch Water District. The watershed program helps sustain a restored marsh and treats contaminated urban runoff water from San Diego Creek before it enters into Newport Bay in Orange County.
- The Orange County Water District (OCWD) operates the Prado Basin Wetland in Riverside County. In cooperation with the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service, OCWD operates 465 acres of constructed freshwater wetlands to reduce the nitrogen concentration of river water.

Looking to the Future

The region's water agencies generally have solid plans for adapting to changing conditions and meeting future water needs. For example, the 2004 Report on Metropolitan's Water Supplies states, "Metropolitan has a comprehensive supply plan to provide sufficient supplemental water supplies and to provide a prudent supply reserve over the next 20 years and beyond." The Santa Ana Watershed Program (SAWPA) has begun a 10-year integrated program to help, among other things, drought-proof the watershed so that it can roll off imported water for up to three years during drought years. Water districts in the Santa Clarita Valley of Los Angeles County are engaged in integrated urban water management planning, collaborative data collection, and a new groundwater plan. These and other ongoing planning programs are important to manage changing conditions facing the region. Water conservation programs, water recycling, and groundwater recovery, as well as water marketing and other water supply augmentation responses are being examined and implemented.

Integrated Resource Planning

MWD adopted its Integrated Resource Plan (IRP) in 1996 and recently has revised that plan with the adoption of the 2004 Update. The new 2004 Update accomplishes the three objectives of reviewing goals and achievements of the 1996 IRP, identifying changed conditions for water resource development, and updating the resource targets through 2025.

SAWPA recently completed its 2002 Integrated Water Resource Plan. It provides information on water demand and supply planning, water resource plans from member agencies, balancing and integrating available resources, and identifying regional problems and issues and potential long-term solutions.

The signing of the Quantification Settlement Agreement and related agreements in October 2003 facilitated long-term water transfers from the IID in the Colorado River Hydrologic Region to urban water users in the South Coast Hydrologic Region. They will help California reduce its use of Colorado River water over time to its basic allotment of 4.4 million acre-feet during years of normal hydrologic flow. They will also make possible the transfer of additional water to be obtained through the lining the All American and the Coachella Canals. The water transfer between IID and SDCWA will help to stabilize San Diego and CVWD's water supplies, satisfy outstanding miscellaneous and Indian water rights, and provide funding that IID and farmers in the Imperial Valley will use to implement additional water conservation measures once the required fallowing is complete.

Key Elements of Colorado River Quantification Settlement Agreement

The Colorado River Quantification Settlement Agreement will have the following effects:

- Have California adopt specific, incremental steps to gradually reduce its use of Colorado River water over the next 14 years to its basic annual allotment of 4.4 million acre-feet.
- Provide Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming with certainty on use of the river, allowing them to take their full allotments to meet future water needs.
- Restore California's and Nevada's privileges to draw extra water from the Colorado River to meet the needs of urban Los Angeles and Las Vegas.
- Transfer as much as 30 million acre-feet of water from farms to cities in Southern California over the life of the agreement.
- Settle a lawsuit between the Imperial Irrigation District and the U.S. Department of Interior (DOI), in which DOI had accused the farming region of wasting water.
- Launch an ambitious plan to reduce Salton Sea salinity, which receives agricultural waste water from Imperial Valley farms, and enhance the Sea and adjacent wetlands for migratory birds.
- Provide for $163 million to offset the environmental impacts of the water transfer in the arid Imperial Valley and help fund the cost of restoring the Salton Sea.
- Fund a $200 million project to line the earthen All-American Canal, which delivers Colorado River water to the Imperial Valley, with concrete. The SDCWA will fund the project and receive 77,000 acre-feet of the water that is conserved.
- Quantify for the first time the total Colorado River allotments for water districts within California.

MWD will continue its replenishment services pricing program to encourage local agencies to store imported water in groundwater basins for use during the summer and during drought years. In addition, local agencies in the region are now planning to use water transfers for part of their base supplies, a change from past years when marketing arrangements were viewed as primarily for drought year supplies.

Ocean water desalination is sometimes described as the ultimate solution to Southern California's water supply shortfall. While it has become a more feasible source of supply due to technical advances, the development of desalination facilities still faces many challenges that include high energy requirements, environmental impacts of brine disposal, and plant-siting considerations. State agencies have provided funding for the Desalination Research and Innovation Partnership, which furthered the development of advance reverse osmosis membranes.

MWD and five of its member agencies have planned the development of 126,000 acre-feet of desalinated ocean water. Those member agencies include LADWP, Long Beach Water Department, Municipal Water District of Orange County, WBMWD, and SDCWA. The SDCWA expects desalted ocean water to meet between 6 and 15 percent of the region’s needs by 2020 and is conducting an environmental review for building an ocean water desalination facility on the Encina Power Plant property in Carlsbad. SDCWA also is carrying out feasibility studies of desalination facilities at Camp Pendleton and in the southern county. All three sites are on the coast.

Another future water supply option is management of the San Bernardino Basin as a groundwater storage facility. The basin has a capacity of about 5.5 million acre- feet. Pursuant to the January 1969 settlement for Western Municipal Water District *et al*. vs. East San Bernardino Valley Municipal Water District *et* *al.* Superior Court Riverside County Case number 78426, the Western-San Bernardino Watermaster determined that the safe yield of the San Bernardino Basin is about 232,000 acre-feet per year. SBVMWD has been working with USGS for many years to develop a groundwater model that will enable the agency to enhance the safe yield of the basin.

The Groundwater Replenishment System, a high-tech water purification system, is a project of the OCWD and the OCSD. It will replace Water Factory 21, which was shut down in January 2004 in anticipation of construction of the new, larger system. The project will take highly treated wastewater and treat it beyond drinking water standards for groundwater recharge and injection into the seawater barriers along the coast. It will provide a second and reliable source of water to recharge the Orange County Basin; protect the basin from further water quality degradation brought on by sea water intrusion; and augment the existing recycled water supply for irrigation and industrial uses. In its first phase, the Groundwater Replenishment System will provide up to 72,000 acre-feet per year and allow for future expansion. It is expected to go online in 2007.

Flood control reservoirs are now being evaluated for their potential to provide some water supply benefits through the modification of the operation of the facilities to enhance groundwater recharge and provide limited year-round storage. The SBVMWD, for example, has applied to the SWRCB for authorization to store storm water from the Santa Ana River in a reservoir that could be created by Seven Oaks Dam. Los Angeles County Department of Public Works (LACDPW) is completing a study, in cooperation with the Army Corps of Engineers, to reauthorize four Corps flood control facilities in Los Angeles County for the purpose of capturing and safely storing storm water and then slowly releasing the water to downstream groundwater recharge facilities after storm events.

The Water Augmentation Study is a long-term research project, led by the Los Angeles and San Gabriel Rivers Watershed Council and supported financially by its partners, the USBR, MWD, LACDPW, Los Angeles RWQCB, Water Replenishment District of Southern California, LADWP, City of Los Angeles Watershed Protection Division, DWR, and the city of Santa Monica. The purpose of the study is to explore the potential for increasing local water supplies and reducing urban runoff pollution by increasing infiltration of storm water runoff upstream. The project began in January 2000 to assess the impact of runoff-transported pollutants on rivers, coastal water, and beaches; the viability of adding these storm water resources to local water supplies, and the challenge of capturing storm water for infiltration, in terms of groundwater quality and quantity.

Two Examples of ongoing ecosystem restoration projects:

The Matilija Dam Ecosystem Restoration Feasibility Study evaluated alternatives and has provided a draft recommendation for removing the 160-foot high dam, including stored sediment, to restore the Ventura River ecosystem. The Public Draft Report was released in July 2004.

The Santa Ana River Trail and Parkway Project includes planning of recreational uses that showcase the river and provide a place for people to enjoy this important resource.

In 2000, DWR, in cooperation with the USBR and 10 Southern California water and wastewater agencies, undertook the Southern California Water Recycling Projects Initiative to continue the work begun during the Southern California Comprehensive Water Reclamation and Reuse Study (SCCWRRS). The initiative is a multiyear planning study that evaluates the feasibility of a regional water-recycling plan and assists local water and wastewater agencies in final planning and environmental documentation leading to implementation of projects identified in the SCCWRRS. The initiative is funded on a 50-50 percent cost-sharing among the 12 agencies. The initiative identified short-term projects that could add about 378,000 acre-feet of recycled water for regional use. The 15 short-term projects identified were as follows: Calleguas, East San Gabriel, West Basin, Central Basin, North Orange County, Central Orange County, Upper Oso, San Juan, Encina, San Pasqual Valley, North City, South Bay, Chino Basin, San Bernardino, and Eastern.

As part of a regional strategy to improve water supply reliability, several agreements with water districts in the Central Valley are providing groundwater storage for the South Coast region:

- Semitropic Water Banking and Exchange Program. This program allows storage of up to 350,000 acre-feet in the groundwater basin underlying the Semitropic Water Storage District in Kern County.
- Arvin-Edison Water Storage Program. MWD and the Arvin-Edison Water Storage District have developed a program that allows Metropolitan to store water in the groundwater basin in the Water Storage District's service area in Kern County. Over the next 25 to 30 years, this groundwater storage program will provide average dry-year withdrawals of about 70,000 acre-feet annually.
- Kern-Delta Storage Program. This 25-year program will allow storage of up to 250,000 acre-feet of available State Water Project supplies.

Other potential management strategies includes interstate groundwater banking in Arizona, drought year land fallowing programs, lining parts of the All-American and Coachella canals, and agricultural water conservation beyond EWMP implementation. In addition, South Coast region water agencies are storing discounted winter-imported water in groundwater basins and increasing their groundwater use during the summer and during droughts.

The Calleguas Municipal Water District operates a conjunctive use program in the Las Posas Groundwater Basin of Ventura County. Identified as the Las Posas Basin Aquifer Storage and Recovery Project, it is designed to store a maximum of 300,000 acre-feet of water supplies that can be used during short-term and long-term water supply shortages. The project calls for the construction of 30 dual-purpose wells that will be used for both injection and production. Pipelines will be constructed to connect the wells with CMWD facilities as far away as the Cities of Simi Valley and Thousand Oaks. The source of water supplies would be the State Water Project. The project will be phased into operation with full operation anticipated by 2010. To date, 18 wells have been built and about 50,000 acre-feet of water is in storage.

To improve the reliability of its potable water supplies during droughts, the Western Municipal Water District is moving forward with plans to operate a conjunctive use program in groundwater basins in western San Bernardino and Riverside counties. The project, the Riverside-Corona Feeder, calls for the recharge of water supplies during above-average precipitation years into the groundwater basins in San Bernardino Valley and pumping those supplies during drought years. Sources of water for the recharging operations would be local surface runoff, including releases from the Seven Oaks Reservoir near the community of Mentone in San Bernardino County and the SWP. Recipients of the stored groundwater supplies are cities of Corona and Riverside and the Elsinore Valley Water District. When completed, 20 wells and 28 miles of pipeline will have been built. About 40,000 acre-feet of groundwater supplies could be moved by the project.

Most of the projects described above are designed to improve water quality as the way to increase water supply. These include watershed activities, such as the Water Augmentation Study, groundwater desalination, use of highly treated recycled water by the Orange County Water District, reduction of sewage spills and storm water runoff through water conservation, and surface and groundwater storage project that implement blending and treatment strategies to reduce disinfection byproducts and other regulated and unregulated contaminants in treated drinking water supplies.

In addition, MWD has committed to retrofitting all five of its water treatment plants to use ozone; adding fluoride to treated drinking water supplies; implementing a recreation policy for Diamond Valley Lake that protects drinking water quality; supporting salinity reduction projects in the region; and outside the region helping preserve and enhance the Sacramento River Watershed, which is an important source of water for the State Water Project system.

Water Portfolios for Water Years 1998, 2000 and 2001

Hydrologic conditions for water years 1998, 2000, 2001 impacted the water supply and water use characteristics for the South Coast Hydrologic Region. In water year 1998, rainfall totals ranged from 170 percent of average in San Diego County to more than 250 percent of average in Ventura County with more than 50 percent of the annual precipitation in January and February. In comparison, during water year 2000 rainfall totals ranged from 60 percent of average in San Diego County to more than 100 percent of average in Ventura County. Precipitation amounts for the region for water year 2000 were average to moderately below average. Rainfall deficits increased from north to south. Water year 2001 was a dry year.

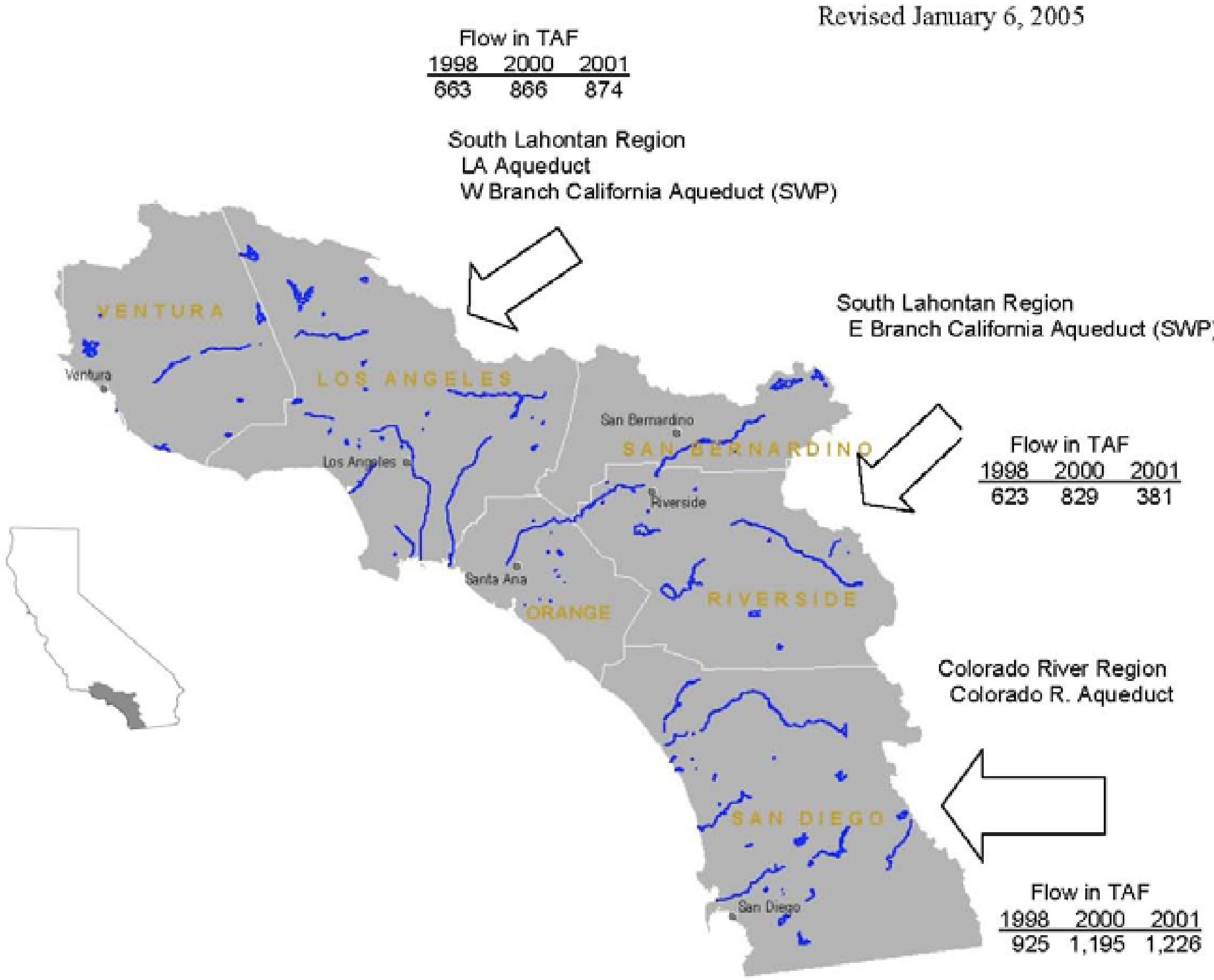
Table 5-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. The Water Portfolio Table (Table 5-2) and companion Water Portfolio Flow Diagrams (Figures 5-7, 5-8, and 5-9) provided more detailed information about how the available water supplies are distributed and used throughout this region.

A more detailed tabulation of the dedicated portion of the total available water used for urban, agricultural and environmental purposes is presented in Table (Table 5-3). The South Coast Region's relatively high level of urban development is reflected in its water use patterns. In 1998, 78 percent of all applied water use in the region was urban. In 2000 and 2001, urban use accounted for about 81 percent of total water use in regional. By contrast, agriculture only accounted for 15 percent of all applied water in 1998, 17 percent in 2000, and 15 percent in 2001. Table 5-2 also provides detailed information about the sources of the developed water supplies, which are obtained from a mix of both surface water and groundwater supplies.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- Annual Progress Report to the California State Legislature, MWD, February 2004
- Annual Report of the Santa Clarita Valley Water Purveyors
- Correspondence with watershed and water wholesale and retail delivery agencies.
- San Diego County Water Authority – Water Management – Recycling Web site: http://www.sdcwa.org/manage/sources-recycling.phtml
- 2002 Statewide Recycled Water Survey, State Water Resources Control Board, 2003. Available: http://www.swrcb.ca.gov/recycling/recyfund/munirec/index.html
- Groundwater Replenishment System Web site: http://www.gwrsystem.com/
- Matilija Dam Ecosystem Restoration Feasibility Study. Public Draft Report. July 2004. Available: http://www.matilijadam.org/public-report.htm

Figure 5-1
South Coast Hydrologic Region



Some Statistics

- Area - 10,925 square miles (6.9 % of State)
- Average annual precipitation – 17.6 inches
- Year 2000 population - 18,223,425
- 2030 projected population – 23,827,075
- Total reservoir storage capacity - 3,059 TAF
- 2000 irrigated agriculture - 280,260 acres

Figure 5-2
South Coast Hydrologic Region Population

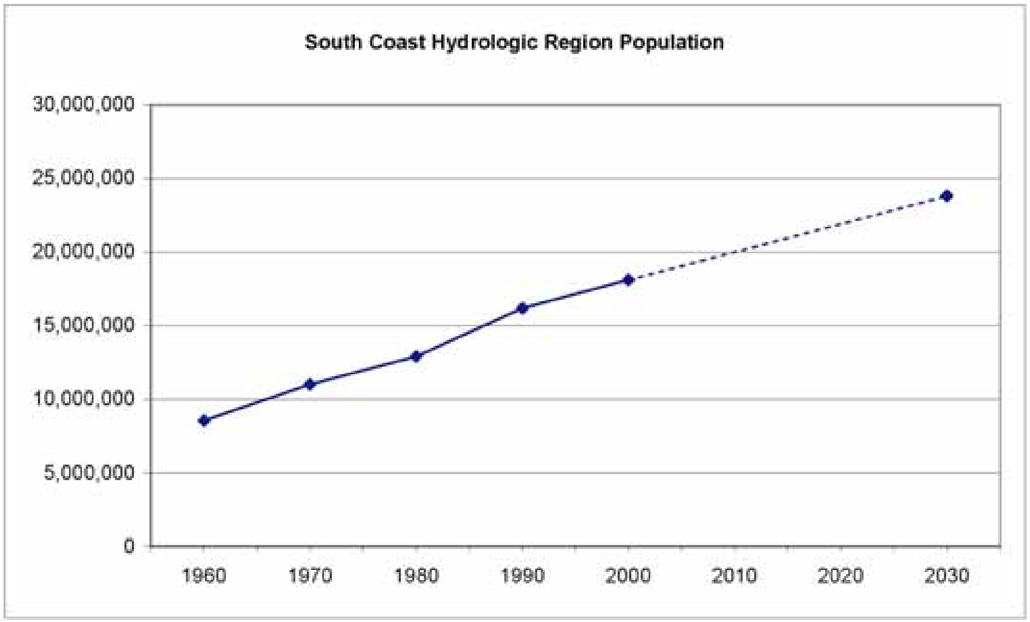


Figure 5-3
South Coast Region Applied Water Uses For Water Years 1998, 2000, 2001

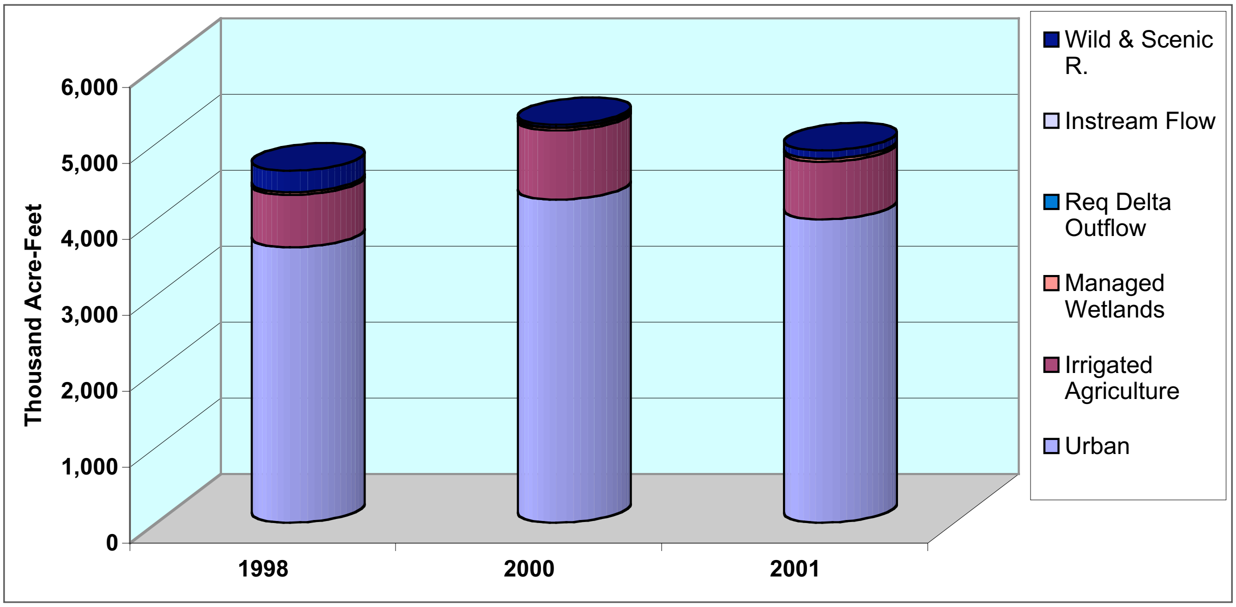


Figure 5-4
South Coast Region Dedicated Water Supplies For Water Years 1998, 2000, 2001

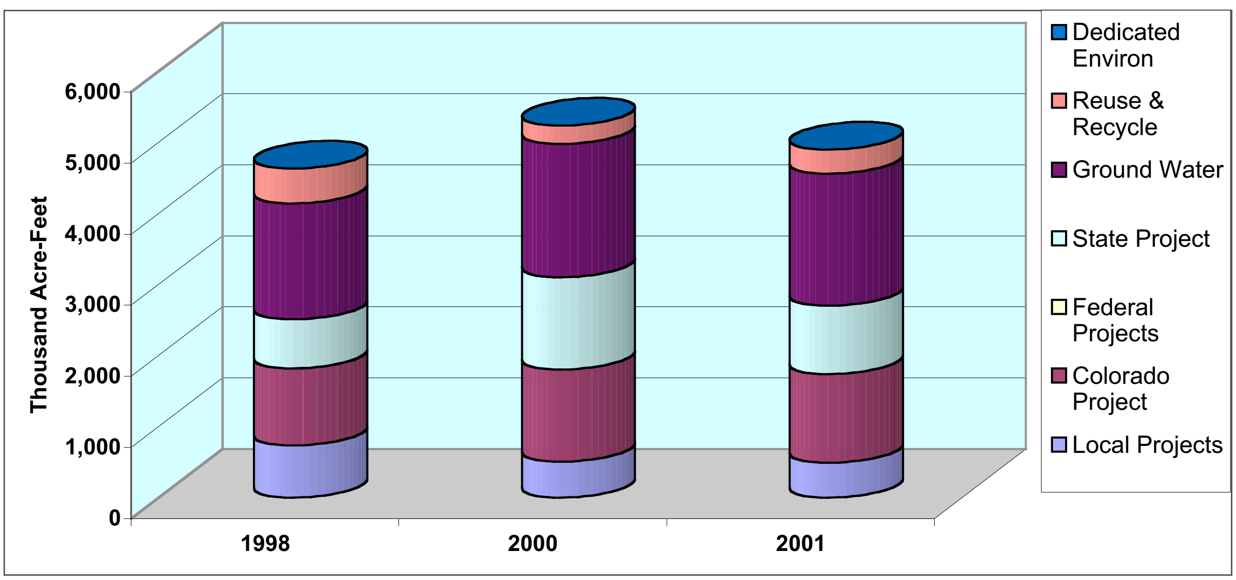


Figure 5-5
MWD Inland Feeder

Figure 5-6
San Joaquin Valley Agencies Having Storage Agreements with Metropolitan

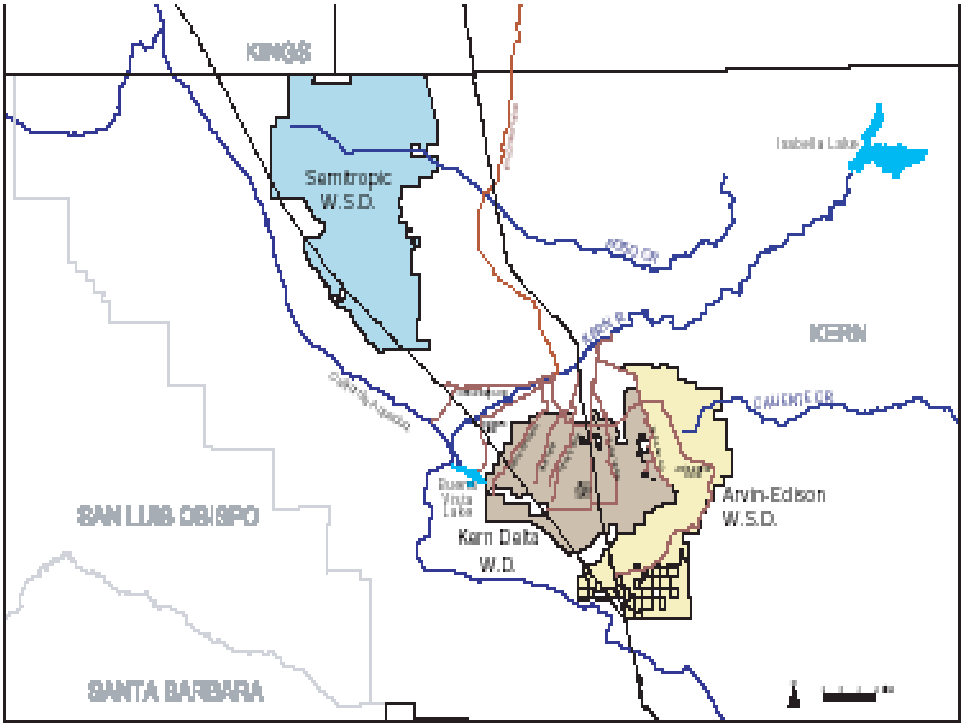


Table 5-1
South Coast Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	Water Year (Percent of Normal Precipitation)		
	1998 (205%)	2000 (72%)	2001 (92%)
Water Entering the Region			
Precipitation	20,873	7,522	9,327
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	1,081	1,296	1,251
Imports from Other Regions	2,578	3,045	2,735
Total	**24,532**	**11,863**	**13,313**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	1,468	1,819	1,628
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	0	0	0
Statutory Required Outflow to Salt Sink	0	0	0
Additional Outflow to Salt Sink	2,110	2,498	2,325
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	21,806	8,791	10,428
Total	**25,384**	**13,108**	**14,381**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	372	128	332
Change in Groundwater Storage **	-1,224	-1,373	-1,400
Total	**-852**	**-1,245**	**-1,068**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	4,184	5,041	4,633

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – Spring 1997 to Spring 1998 for the 1998 water year and Spring 1999 to Spring 2000 for the 2000 water year. All other regions and Year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation – withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow

Table 5-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	South Coast 1998 (TAF) Water Portfolio	South Coast 1998 (TAF) Applied Water	South Coast 1998 (TAF) Net Water	South Coast 1998 (TAF) Depletion	South Coast 2000 (TAF) Water Portfolio	South Coast 2000 (TAF) Applied Water	South Coast 2000 (TAF) Net Water	South Coast 2000 (TAF) Depletion	South Coast 2001 (TAF) Water Portfolio	South Coast 2001 (TAF) Applied Water	South Coast 2001 (TAF) Net Water	South Coast 2001 (TAF) Depletion	Data Detail
Inputs:														
1	Colorado River Deliveries		1,081.3				1,296.0				1,250.5			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	20,873.0				7,522.1				9,327.0				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		292.1				211.4				217.1			PSA/DAU
10	Local Imports		442.0				294.0				272.0			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		-				-				-			PSA/DAU
12	Other Federal Deliveries		4.2				0.6				-			PSA/DAU
13	State Water Project Deliveries		687.7				1,300.1				958.7			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow Applied Water		3.5				3.5				3.5			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetlands		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		-				-				-			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		-				-				-			PSA/DAU
b	Recycled Water - Urban		202.4				182.7				188.8			PSA/DAU
c	Recycled Water - Groundwater		2.1				37.1				36.2			PSA/DAU
20a	Return Flow to Developed Supply - Ag		-				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		-				-				-			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		87.2				114.4				95.2			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		-				-				-			PSA/DAU
c	Deep Percolation of Applied Water - Urban		321.6				386.5				367.0			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		-				-				-			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		287.7				37.8				111.7			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	1,380.6				1,515.5				1,643.3				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	786.0				865.0				841.3				PSA/DAU
29	Groundwater Extractions - Unadjudicated	846.3				1,008.4				1,020.9				REGION
Withdrawals:	In Thousand Acre-feet													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	1,752.5				1,643.3				1,975.6				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				18.5				18.5				17.9	REGION
b	Evaporation from Reservoirs				149.1				164.2				160.8	REGION
36	Ag Effective Precipitation on Irrigated Lands		256.8				150.2				166.1			REGION
37	Agricultural Water Use		691.9	604.7	606.1		908.4	794.0	795.9		758.4	663.2	665.3	PSA/DAU
38	Managed Wetlands Water Use		31.2	31.2	31.2		38.1	38.1	38.1		37.2	37.2	37.2	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		990.7				1,252.8				1,144.3			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		670.2				752.1				709.0			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		603.2				543.1				510.0			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		105.9				139.7				151.0			PSA/DAU
40	Urban Commercial Use		699.5				914.1				885.5			PSA/DAU
41	Urban Industrial Use		186.0				209.8				209.8			PSA/DAU
42	Urban Large Landscape		165.7				242.8				187.5			PSA/DAU
43	Urban Energy Production		39.8				39.8				39.8			PSA/DAU
44	Instream Flow		3.5	-	-		3.5	-	-		3.5	-	-	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild and Scenic Rivers		284.2	-	-		34.3	-	-		108.2	-	-	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				494.8				645.8				542.9	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				31.2				38.1				37.2	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				941.8				1,134.6				1,047.5	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				-				-				-	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				11.2				15.0				12.3	PSA/DAU
50	Urban Waste Water Produced	1,824.8				2,156.8				2,015.9				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				346.5				362.5				358.5	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				-				-				-	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				100.1				135.1				110.1	PSA/DAU
b	Return Flows to Salt Sink - Urban				2,009.7				2,363.3				2,214.8	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				-				-	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				-				-				-	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	2,578.1				3,045.1				2,734.5				REGION
56	Regional Exports	0.0				0.0				0.0				REGION
59	Groundwater Net Change in Storage	-1,223.5				-1,372.5				-1,400.0				REGION
60	Surface Water Net Change in Storage	371.9				127.8				332.3				REGION
61	Surface Water Total Available Storage	2,112.7				3,058.8				3,058.8				REGION

Colored spaces are where data belongs. N/A Data Not Available "-" Data Not Applicable "0" Null value

Table 5-3
South Coast Hydrologic Region Water Use and Distribution of Dedicated Supplies - TAF

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	165.7			242.8			187.5		
Commercial	699.5			914.1			885.5		
Industrial	186.0			209.8			209.8		
Energy Production	39.8			39.8			39.8		
Residential - Interior	1,593.9			1,795.9			1,654.3		
Residential - Exterior	776.1			891.8			860.0		
Evapotranspiration of Applied Water		941.8	941.8		1,134.6	1,134.6		1,047.5	1,047.5
Irrecoverable Losses		518.1	518.1		594.5	594.5		570.1	570.1
Outflow		1,678.1	1,678.1		1,976.7	1,976.7		1,850.2	1,850.2
Conveyance Losses - Applied Water	160.0			154.6			153.0		
Conveyance Losses - Evaporation		160.0	160.0		154.6	154.6		153.0	153.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**3,621.0**	**3,298.0**	**3,298.0**	**4,248.8**	**3,860.4**	**3,860.4**	**3,989.9**	**3,620.8**	**3,620.8**
Agriculture									
On-Farm Applied Water	691.9			908.4			758.4		
Evapotranspiration of Applied Water		494.8	494.8		645.8	645.8		542.9	542.9
Irrecoverable Losses		11.2	11.2		15.0	15.0		12.3	12.3
Outflow		100.1	100.1		135.1	135.1		110.1	110.1
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**691.9**	**606.1**	**606.1**	**908.4**	**795.9**	**795.9**	**758.4**	**665.3**	**665.3**
Environmental									
Instream									
Applied Water	3.5			3.5			3.5		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Wild & Scenic									
Applied Water	284.2			34.3			108.2		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	31.2			38.1			37.2		
Evapotranspiration of Applied Water		31.2	31.2		38.1	38.1		37.2	37.2
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	31.2	31.2	31.2	38.1	38.1	38.1	37.2	37.2	37.2
Total Environmental Use	**318.9**	**31.2**	**31.2**	**75.9**	**38.1**	**38.1**	**148.9**	**37.2**	**37.2**
TOTAL USE AND LOSSES	**4,631.8**	**3,935.3**	**3,935.3**	**5,233.1**	**4,694.4**	**4,694.4**	**4,897.2**	**4,323.3**	**4,323.3**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	292.1	292.1	292.1	211.4	211.4	211.4	217.1	217.1	217.1
Local Imported Deliveries	442.0	442.0	442.0	294.0	294.0	294.0	272.0	272.0	272.0
Colorado River Deliveries	1,081.3	1,081.3	1,081.3	1,296.0	1,296.0	1,296.0	1,250.5	1,250.5	1,250.5
CVP Base and Project Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Federal Deliveries	4.2	4.2	4.2	0.6	0.6	0.6	0.0	0.0	0.0
SWP Deliveries	687.7	687.7	687.7	1,300.1	1,300.1	1,300.1	958.7	958.7	958.7
Required Environmental Instream Flow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Groundwater									
Net Withdrawal	1,223.5	1,223.5	1,223.5	1,372.5	1,372.5	1,372.5	1,400.0	1,400.0	1,400.0
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	408.8			500.9			462.2		
Reuse/Recycle									
Reuse Surface Water	287.7			37.8			111.7		
Recycled Water	204.5	204.5	204.5	219.8	219.8	219.8	225.0	225.0	225.0
TOTAL SUPPLIES	**4,631.8**	**3,935.3**	**3,935.3**	**5,233.1**	**4,694.4**	**4,694.4**	**4,897.2**	**4,323.3**	**4,323.3**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 5-7
South Coast Hydrologic Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

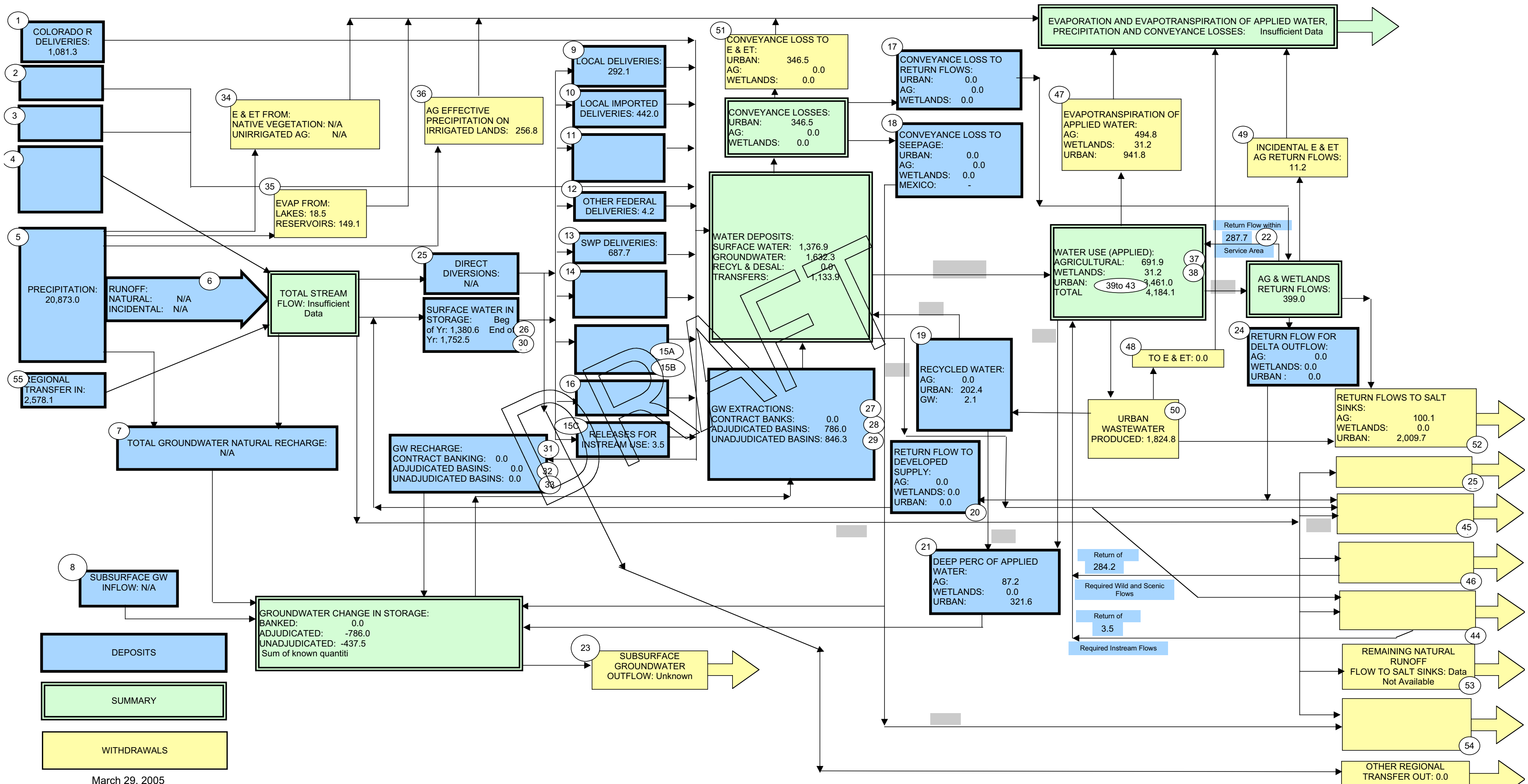


Figure 5-8
South Coast Hydrologic Region 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

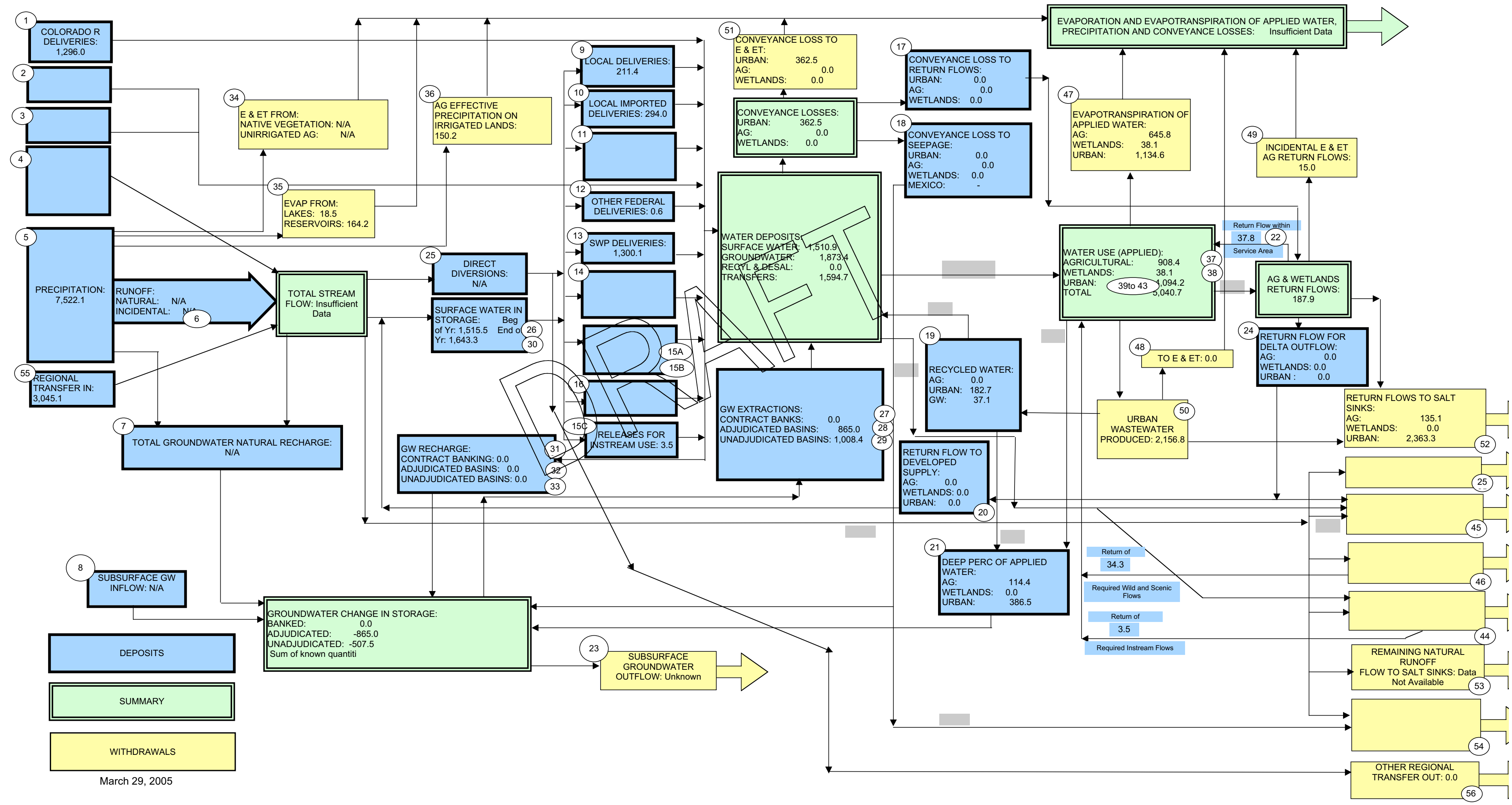
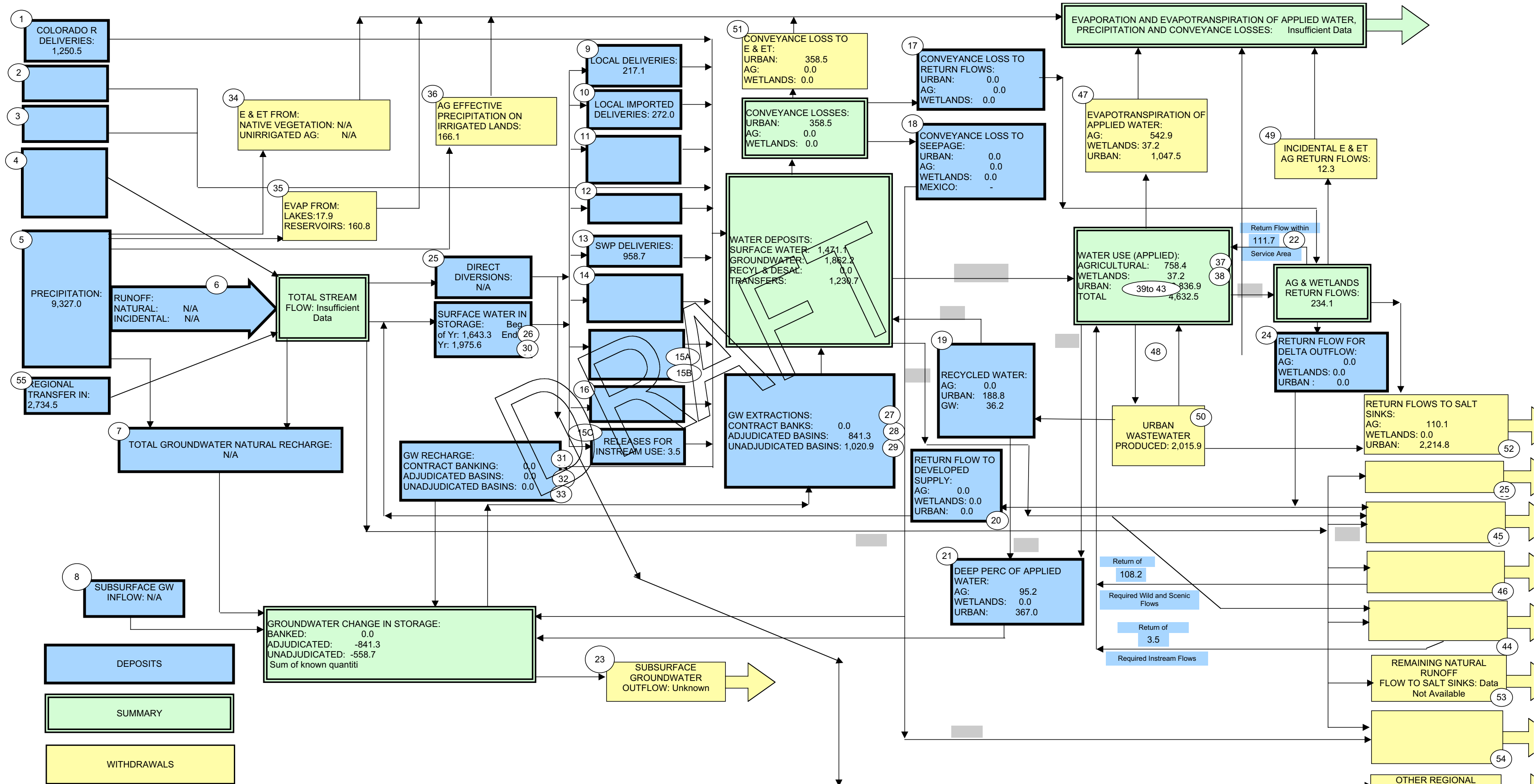


Figure 5-9
South Coast Hydrologic Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



March 29, 2005